



**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Application No.: 10/664,324  
Filing Date: September 17, 2003  
Applicant: Kinser et al.  
Group Art Unit: 3683  
Examiner: Devon C. Kramer  
Title: SYSTEM AND METHOD FOR MAINTAINING A  
VEHICLE AT ZERO SPEED ON A GRADED SURFACE  
Attorney Docket: GP-302282 (8540P-000231)

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Commissioner of Patents and Trademarks  
Washington, D.C. 20231

**DECLARATION UNDER 37 C.F.R. § 1.131**

Sir:

The undersigned co-inventors of the above-identified patent application hereby declare that:

1. We are the inventors of the above-identified application, which was filed on September 17, 2003 with the United States Patent and Trademark Office.
2. We completed the invention in this country prior to December 16, 2002, which is the effective date of U.S. Pat. Pub. No. US2004/0012250 to Kuno et al.
3. The invention was conceived in the United States prior to December 16, 2002 as evidenced by a Record of Invention (ROI) submitted to our employer, General Motors Corporation. A photocopy of the ROI is attached as Exhibit A. The dates that are blacked-out on the ROI of Exhibit A are each prior to December 16, 2002.
4. The invention was reduced to practice in the United States prior to



December 16, 2002 in the form of a compiled and tested computer program. A photocopy of a screen-shot of the graphical tool, Mathworks Simulink, is attached hereto as Exhibit B and illustrates upper level source code as it existed prior to December 16, 2002. The graphical tool was used to compile the executed C code. A screen-shot of the Model Properties for the model illustrated in Exhibit B is attached hereto as Exhibit C and includes a blacked-out date that is prior to December 16, 2002.

5. We have never abandoned the application.

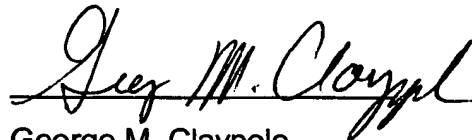
6. We hereby declare that all statements made herein of our own knowledge are true and that all statements made on information and belief are believed to be true and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 the United States Code, and that such willful false statement may jeopardize the validity of the application, and patent issuing thereon, or any patent to which this verified statement is directed.

Date: Sept. 9, 2004



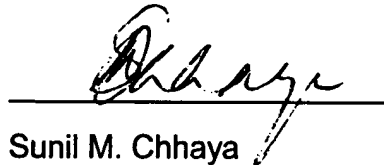
Christopher A. Kinser

Date: SEPT. 9, 2004



George M. Claypole

Date: Sept 9, 2004



Sunil M. Chhaya



CONFIDENTIAL AND PRIVILEGED



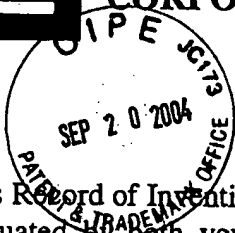
GENERAL MOTORS  
CORPORATION

EXHIBIT

A

File No.

GP-302282  
OFFICE USE ONLY



## RECORD OF INVENTION RECEIVED

GENERAL MOTORS CORPORATION

This Record of Invention must be completed with sufficient detail so that your invention can be understood and evaluated by both your engineering management and by a GM Legal Staff patent attorney. Novelty and competitive significance of your invention will be evaluated based on the information you provide.

Invention Title: Throttle Hold Relief Control

**LEGAL STAFF**

### Inventor #1

Name: Christopher A Kinser Citizen of: United States of America  
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### Inventor #2\*

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\* If there are more than two (2) inventors for this invention use the template at the end of this form.



**Inventor # 3**

Name: Sunil M Chhaya Citizen of: India  
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Street City and State Zip Code

**Inventor #**

Name: \_\_\_\_\_ Citizen of: \_\_\_\_\_  
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Home Address: \_\_\_\_\_  
Street City and State Zip Code  
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Centrex Number  
Non-GM Employer: \_\_\_\_\_ Phone No. \_\_\_\_\_  
(Area Code) + Number  
Non-GM Employer Address: \_\_\_\_\_  
Street City and State Zip Code

**RECEIVED**  
GENERAL MOTORS CORPORATION

**LEGAL STAFF**



**Answer questions 1 - 8, completing all of them to the best of your knowledge.**

1. This invention was first thought of on: [REDACTED]
2. This invention has been or is expected to be disclosed outside GM on: Unknown
3. This invention has been used or is committed to be used in production on: ParadiGM equipped programs
4. This invention has been offered for sale outside GM on: None
5. Was this invention made while working on a Government Contract? ☐ Yes ☒ No

**If yes, identify the government Contract No.**

6. Identify the product or process in which the invention is incorporated: ParadiGM Hybrid-Transaxle
7. List all individuals who can provide information about the making of the invention. This list may include individuals who made the first sketch, description, or tests and individuals who are familiar with the facts relating to the making of the invention.  
Chris Kinser, George Claypole, Sunil Chhaya

8. Each inventor has a legal duty to disclose all information known that is material to patentability of this invention. Such information includes the relevant prior art, which may be in the form of current or past products, equipment, processes, materials, patents, publications, advertisements, displays, and unpublished developments and proposals—whether originated by you, others in GM, competitors, suppliers, customers or others. Such information also includes disclosure of this invention outside GM, sales and offers of products using this invention, use of this invention in production and disputes about who should be considered as an inventor of this invention. To comply with the duty to disclose, list here and attach a copy of all such information, to the extent known.

*See attached patents and publications relevant to prior art:*



**Answer question 9 thoroughly.**

9. Describe the invention in sufficient detail so that its nature, operation and usefulness can be understood. (Attach drawings, diagrams and further description, when necessary. Additional guidelines are listed below.)

Any vehicle (automobile, golf cart, etc.) can be commanded to maintain a zero speed position on a grade by using only a throttle pedal input. A driver can command torque from the powertrain in a forward direction that is equal to the force of gravity in the reverse direction. This would result in a zero speed or near zero speed position on a hill or grade. Many powertrain components such as automatic transmissions and propulsion electrical machines are susceptible to damage under these conditions. An automatic transmission's torque convert will create extreme heat if in this condition for a long period of time and can subsequently result in permanent damage to part. An electrical machine would be caught in a "stall current" mode which also results in extreme heat, large power consumption, and the the risk of damaging the machine.

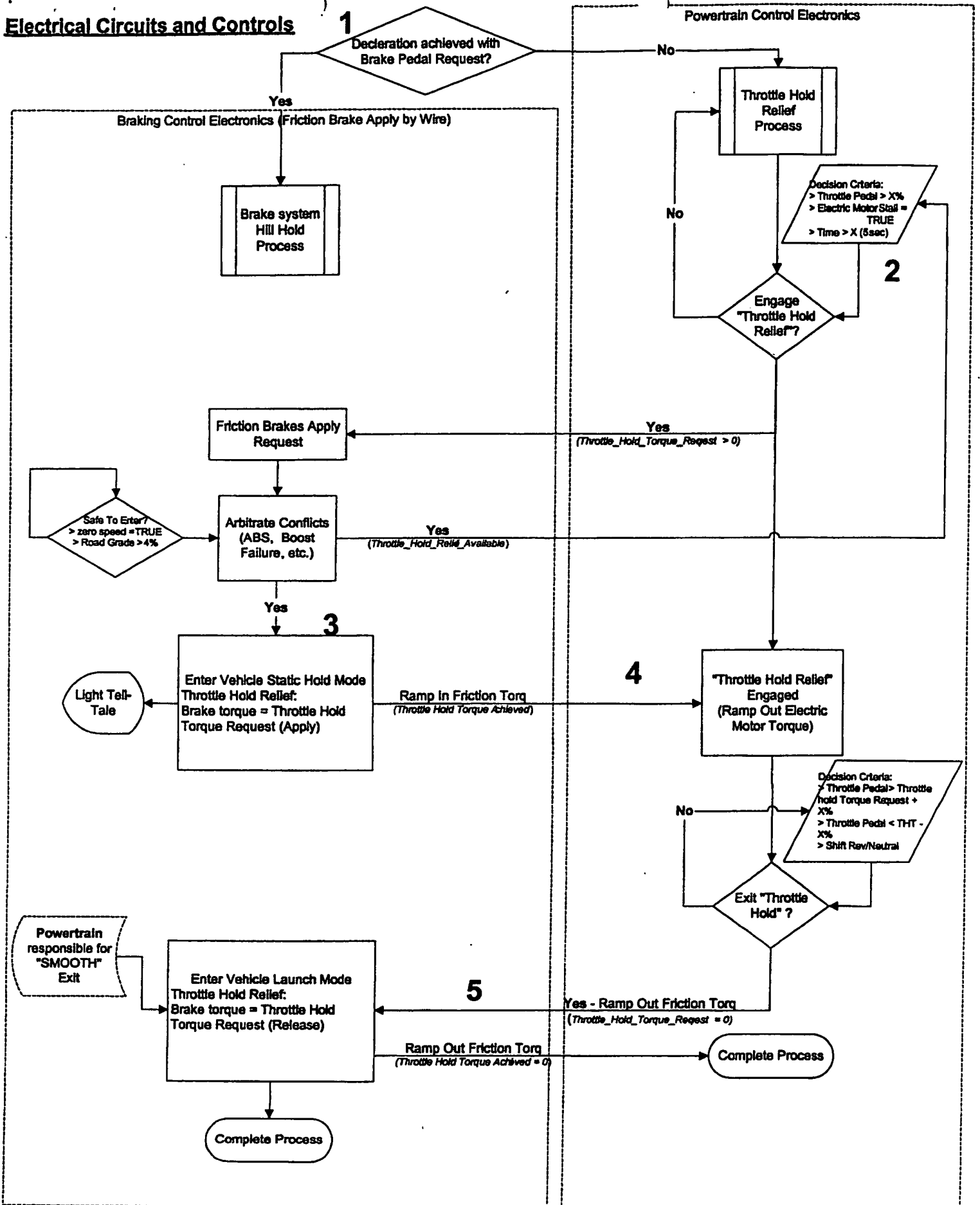
"Throttle Hold Relief Control" will provide a means to relieve the propulsion system from creating stall torque. The vehicle must be equipped with a throttle-by-wire and a brake-by-wire system (Electro-hydraulic brake, electro-mechanical brake, active vacuum booster, etc.).

"Throttle Hold Relief Control" is the process of transferring the torque necessary to hold the vehicle stationary from the powertrain subsystem to the braking subsystem. When the powertrain detects a situation that may cause component damage in a stationary position, the powertrain electronics will make a request (i.e. - Serial Data message, Pulse Width modulated signal, etc.) to the braking subsystem to safely apply the friction brake apply system to actuate. Actuation of the brakes can provide a static friction force that can hold the vehicle in position as the driver is requesting.

The "Thottle Hold Relief Control" process is outlined in the attached Flowchart and Timing Diagrams:  
(See Electrical Circuits and Controls attachments)



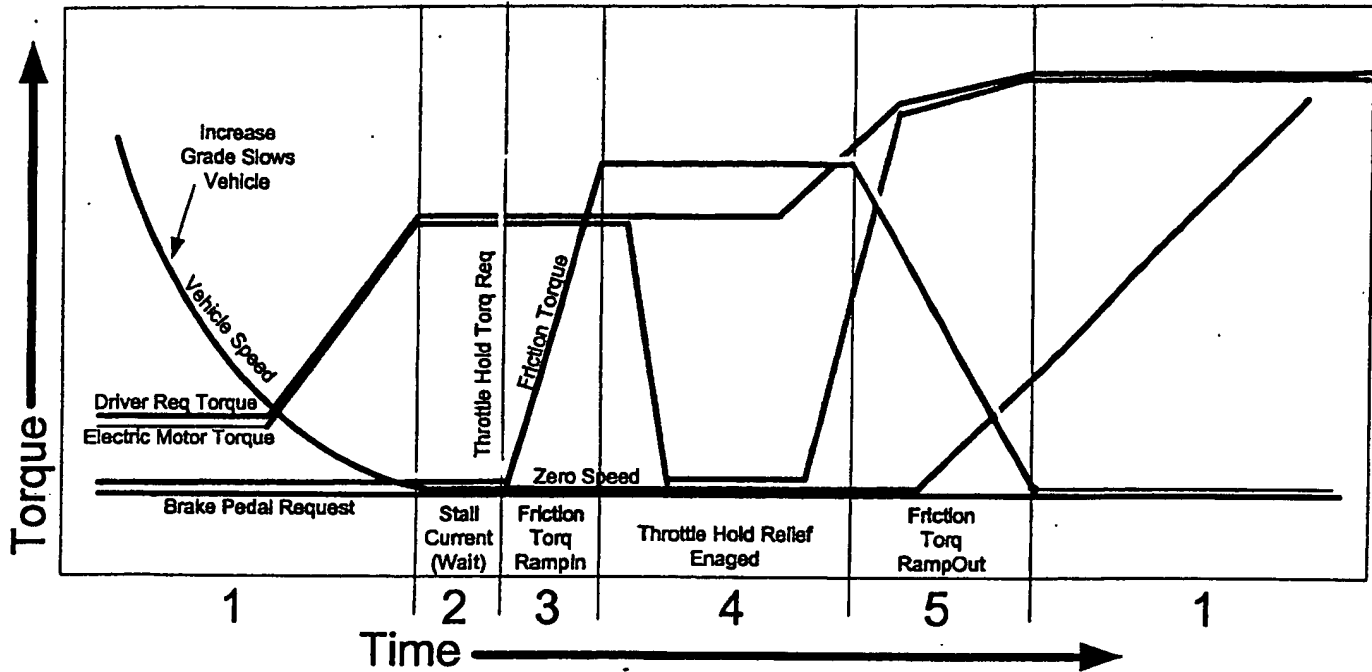
# Electrical Circuits and Controls



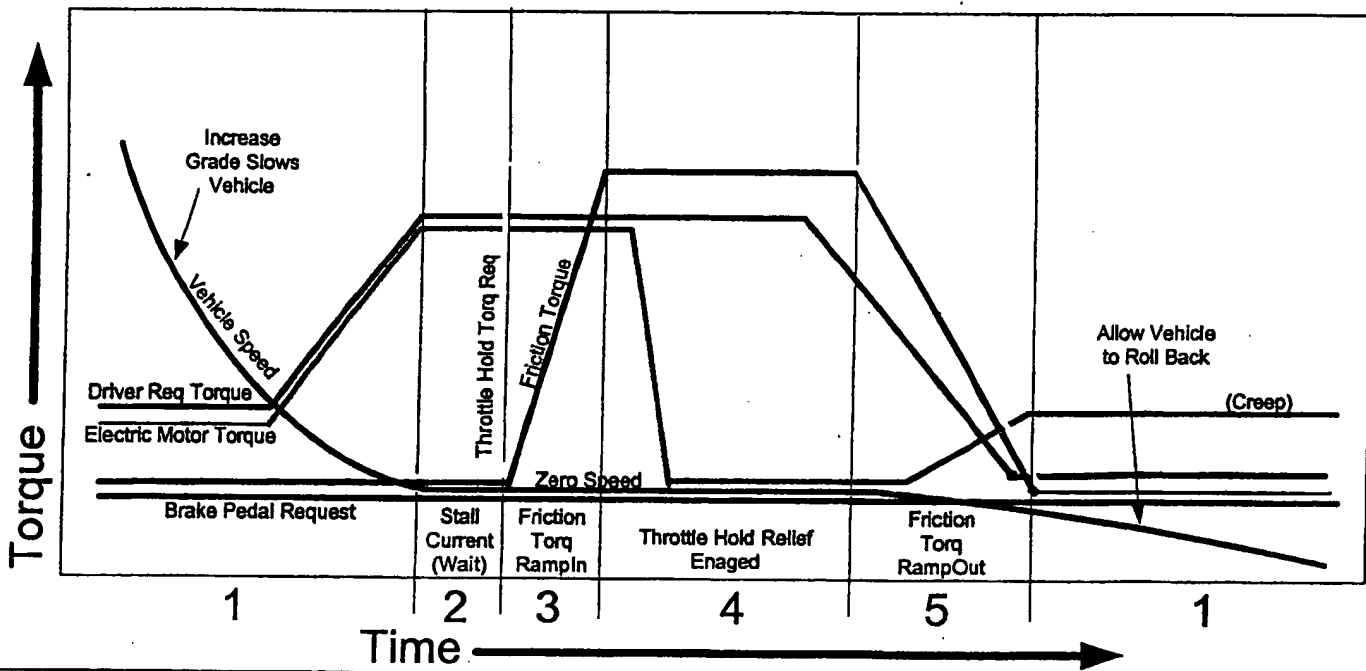


# Throttle Hold Relief Strategy

Increase Accelerator Pedal  
Time vs. Torque



Release Accelerator Pedal - No Brake Apply  
Time vs. Torque

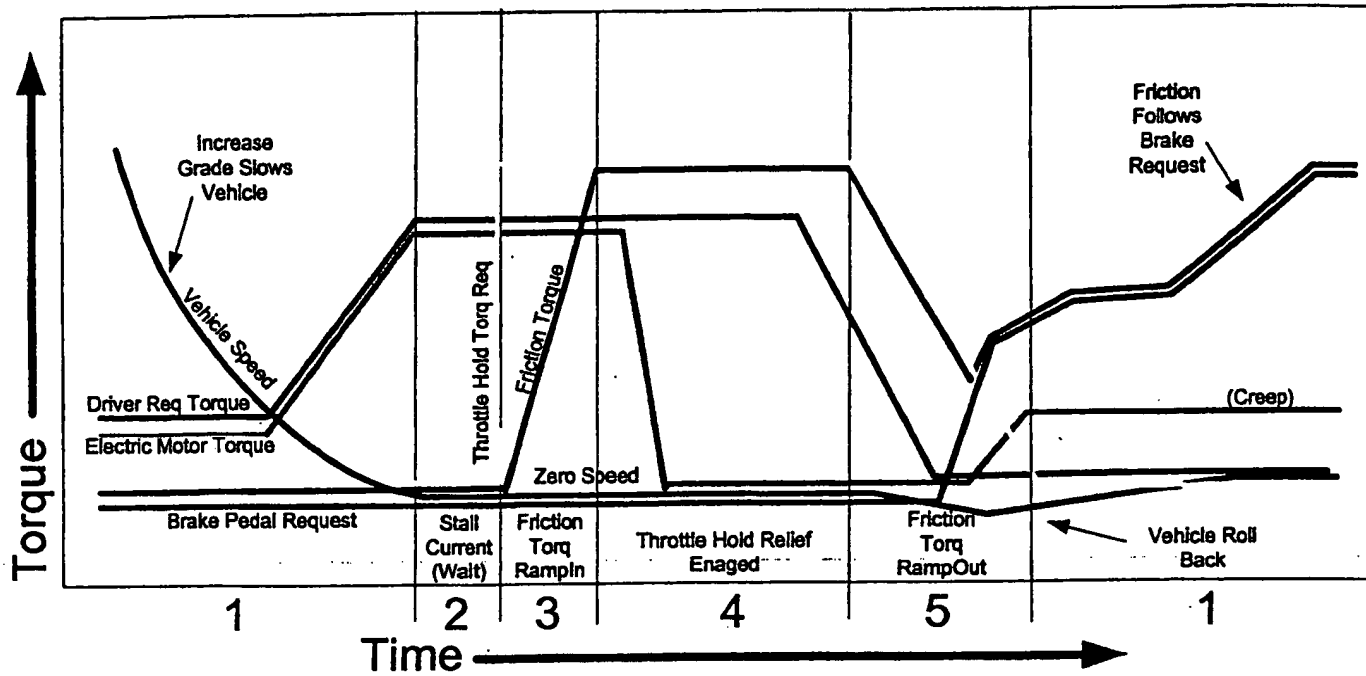


## Legend

- Blue - Vehicle Speed (kph)
- Pink - Driver Requested Torque (Nm)
- Green - Electric Motor Torque (Nm)
- Red - Friction Brake Torque (Nm)
- Throttle Hold Torque Request (Nm)
- Purple - Brake Pedal Request (Nm)



# Release Accelerator Pedal then Apply Brake Pedal Time vs. Torque



## Legend

Blue - Vehicle Speed (kph)  
 Pink - Driver Requested Torque (Nm)  
 Green - Electric Motor Torque (Nm)  
 Red - Friction Brake Torque (Nm)  
 - Throttle Hold Torque Request (Nm)  
 Purple - Brake Pedal Request (Nm)

Chris Kinser - GM Restricted - [REDACTED]



**Question 8 Attachment:**

**Patents Cited:**

EP0170478	US5090511
EP0427138	US5148883
SU839764	US5173860
US3774095	US5215156
US4075538	US5222568
US4750125	US5234262
US4835695	US5263743
US4916619	US5265693
US4917445	US5289093
US4941553	US5320421
US4962969	US5322352
US4969756	US5365431
US5000297	US5378053
	US5390992

**Non-Patent Citations:**

Brake Adjuster Algorithm, Research Disclosure No. 32411, Published Apr. 1991.

Brake Fade Compensation Technique, Research Disclosure No. 31961, Published Nov. 1990.

Surface Adaptive Torque Release, Research Disclosure No. 30762, Published Nov. 1989.

Slip Command Brake Apply System, Research Disclosure No. 31955, Published Nov. 1990.

Vehicle Reference Over-Speed Normalization, Research Disclosure No. 31359, Published May 1990.

Method to Compensate for Velocity Dependent Compliance Variation in Drum Brakes Research Disclosure No. 36801, Published Dec. 1994.

Adaptive Proportioning Fail-Safe, Research Disclosure No. 36621, Published Oct. 1994.

Adaptive Brake Proportioning, Research Disclosure No. 30755, Published Nov. 1989.

Apply Mode Only Logic, Research Disclosure No. 32385, Published Mar. 1991.



**Answer the following questions if helpful in describing this Invention**

10. What benefits will be realized by using this invention?

*1 No added parts cost to the vehicle.*

*2. Transmission damage resulting in increased Incidents Per Thousand Vehicles (IPTV) can be avoided by implementing this control strategy.*

*3. Can be extrapolated to include "Anti-Rollback" feature for marketing the vehicles.*

*4. Enables a lower cost electric machine since it would not be necessary to size for long duration stall torques.*

11. What is the state of development of this invention?

*This algorithm exists only in a design phase and has not been coded or tested.*

12. To the extent known, what alternatives exist for accomplishing substantially the same result as this invention?

*This same functionality could reside in a Brake system controller. Instead of the Powertrain sub-system commanding the brakes to apply, the brake system to detect the need to "hold a vehicle static on grade" and then command the powertrain to shut down forward torque.*

13. Describe the background of the invention. This description may include the state of the prior art and may identify deficiencies in the prior art that are overcome by this invention.

*The concept of "Hill Hold" has been proposed to reside solely in a Brake Controller. "Hill Hold" is the art of detecting a vehicle on a grade and then preventing roll back even if the driver takes their foot off of the brake pedal. This invention, "Throttle Hold Relief", can act independently of this function and provide a means of protecting the powertrain.*



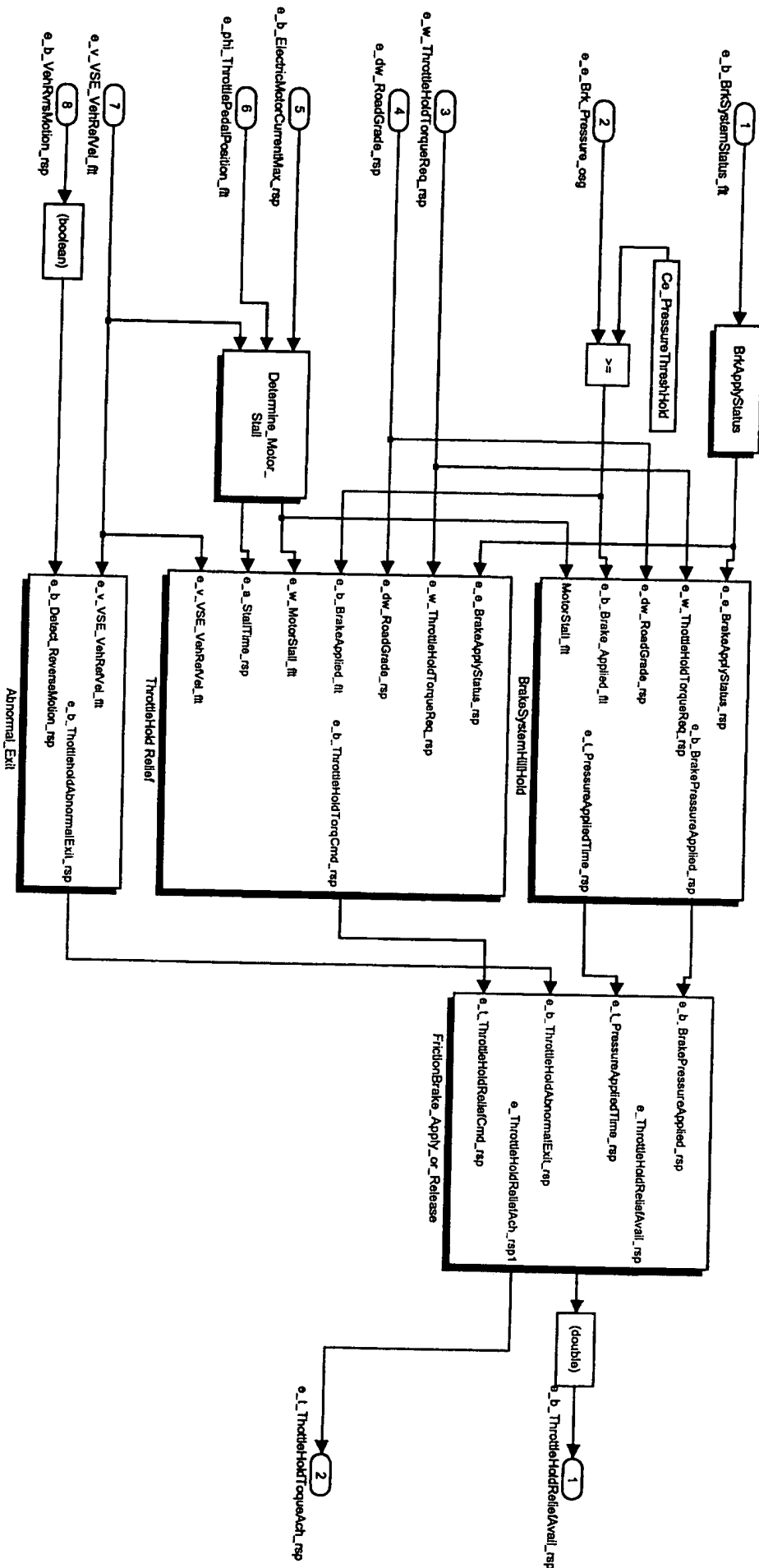
# ThrottleHoldRelief

Trigger

EXHIBIT

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Model Properties: ThrottleHoldRelief\_SubFunc

Summary | Calibrations | History

Version information

View current values

Model version: 1.05

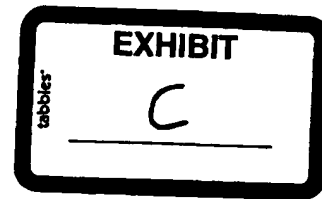
Last saved by: bzm

Last saved on: [REDACTED]

Model history

Prompt to update model history: Never

OK Cancel Help Apply





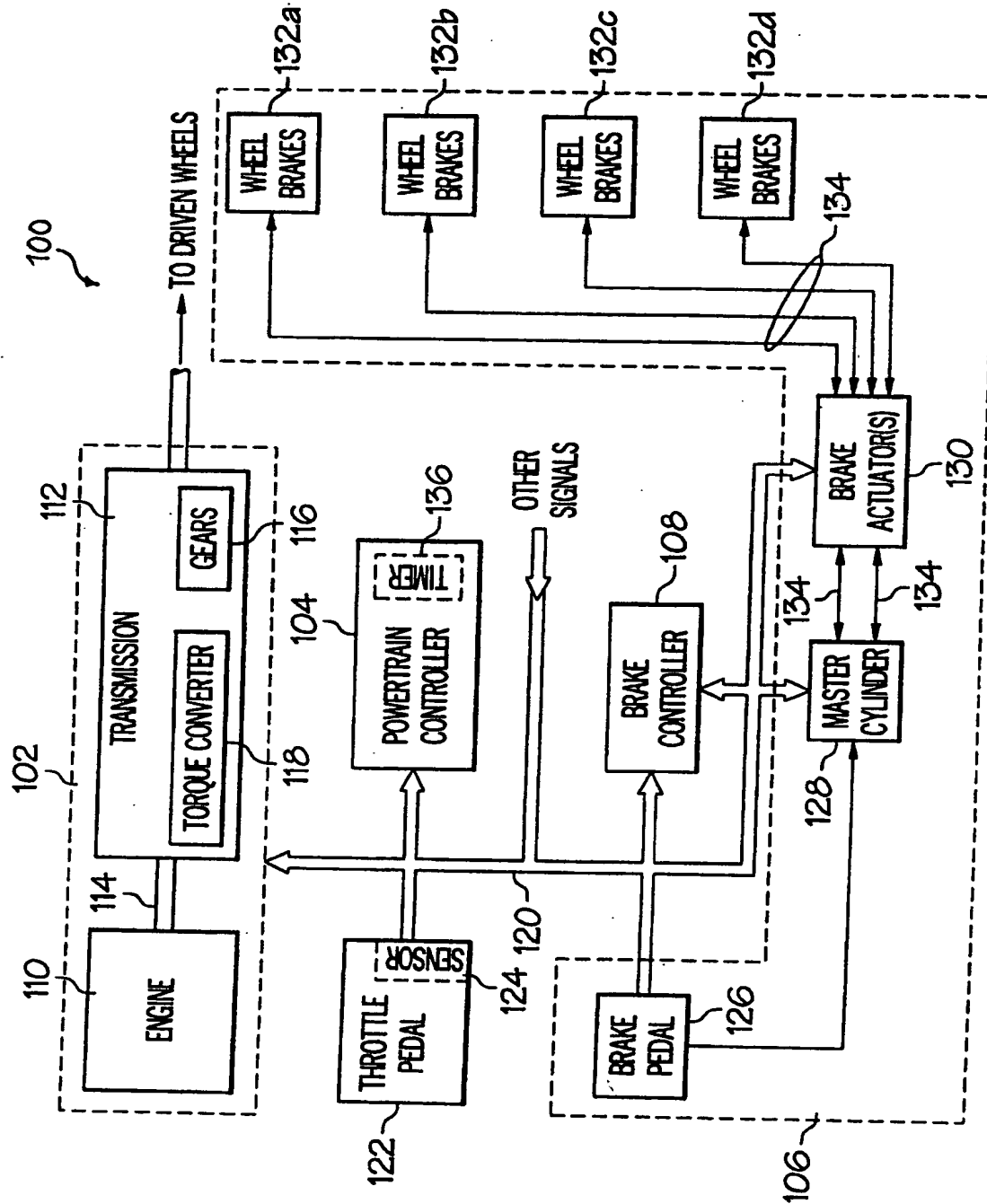
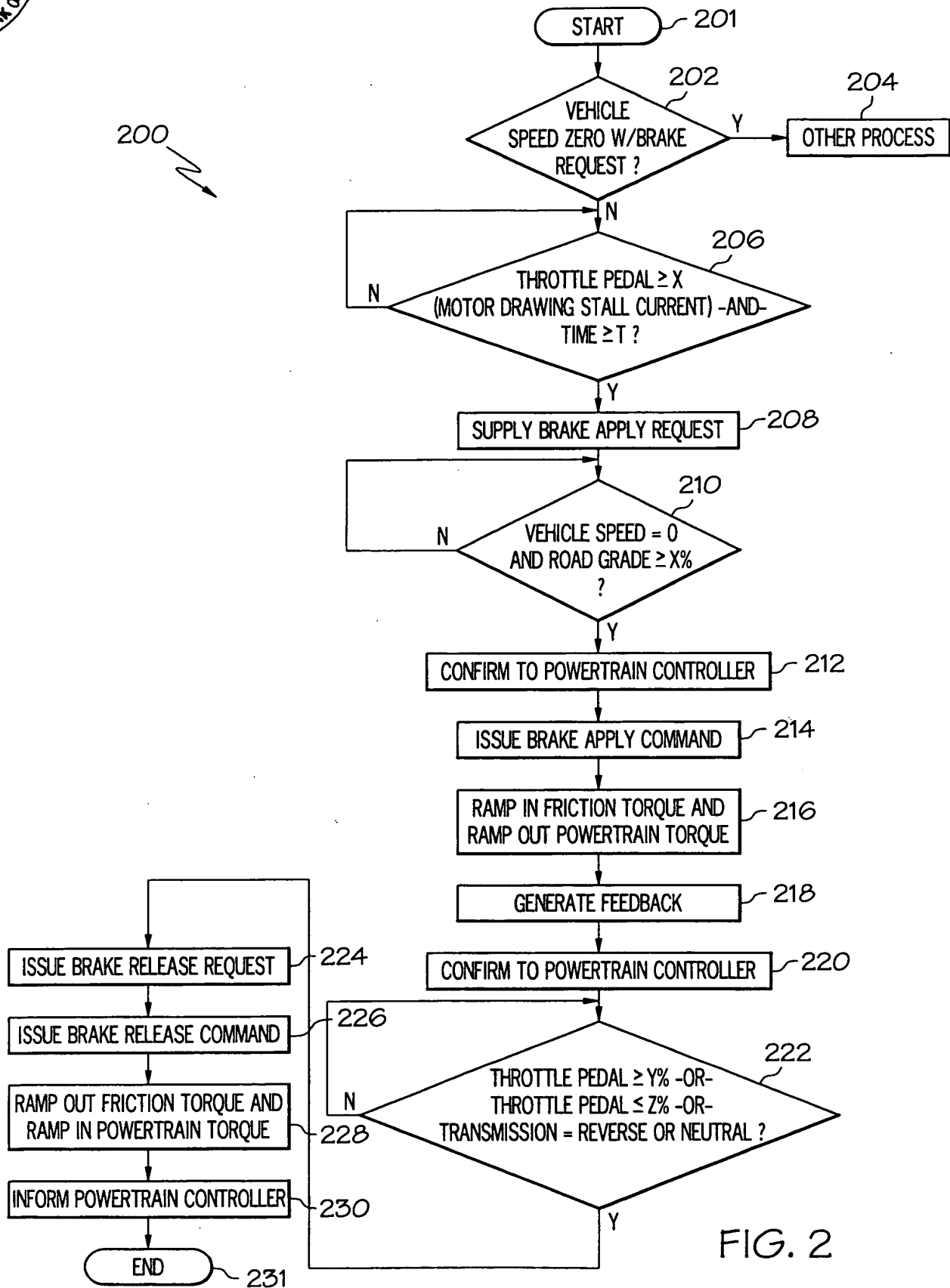
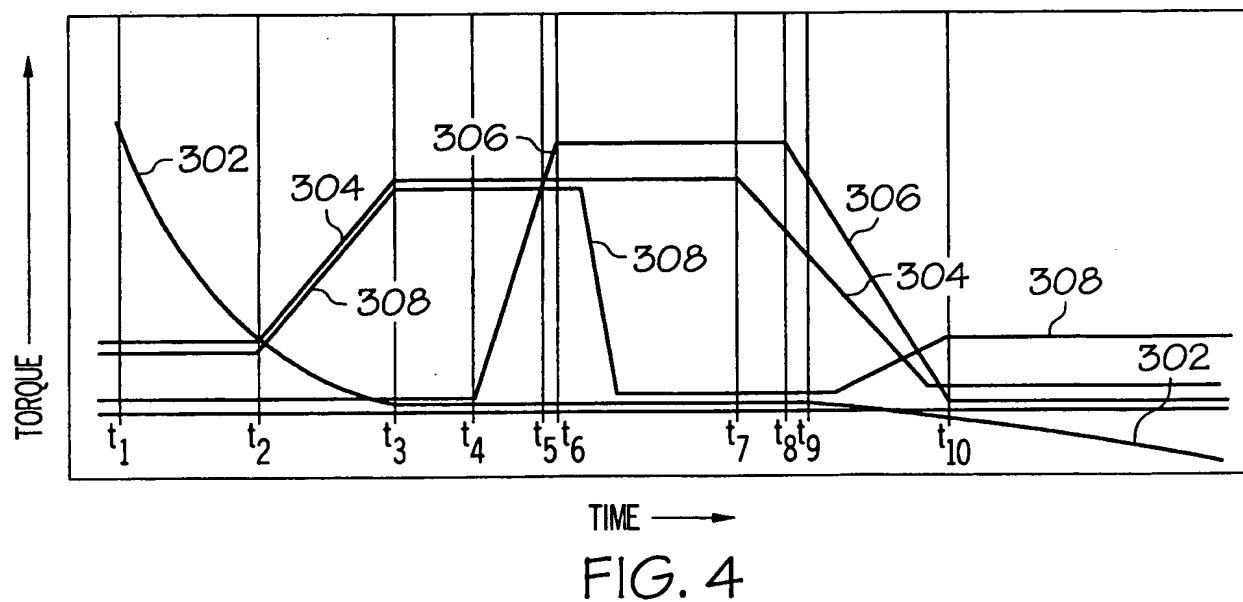
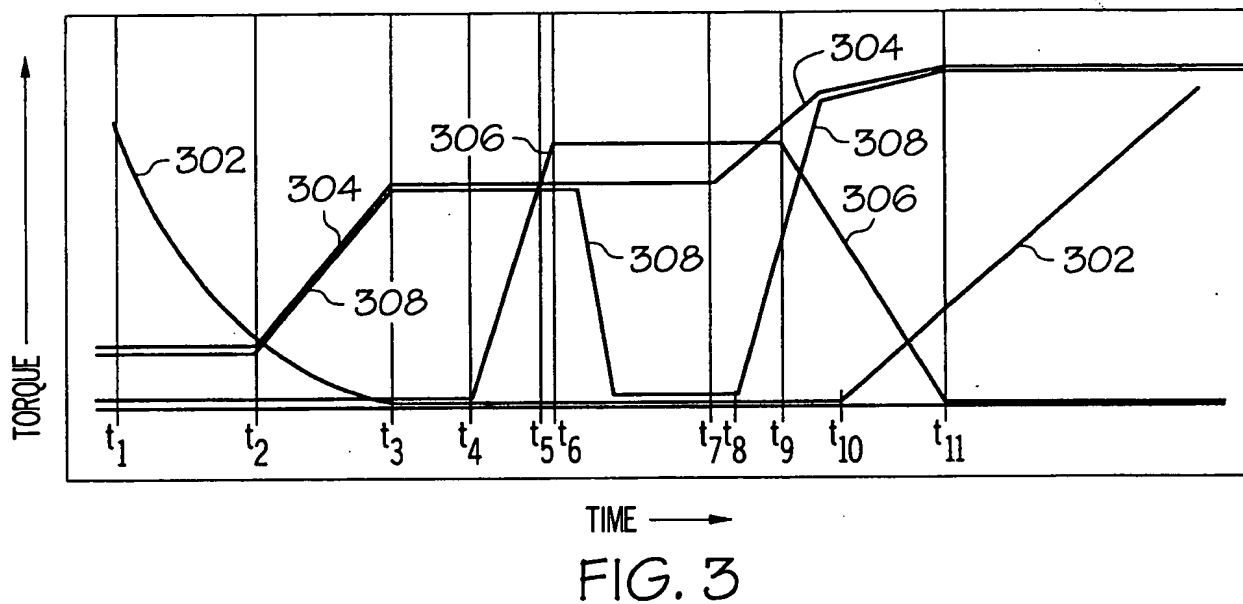


FIG. 1

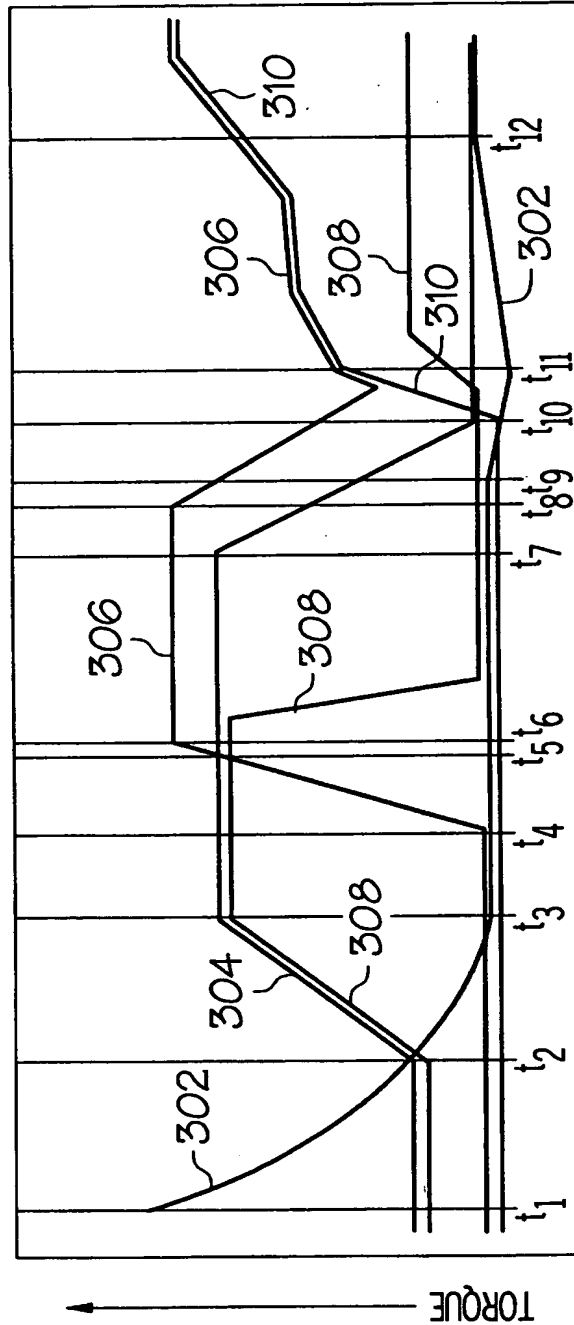












TIME →  
**FIG. 5**